Ω = 13.56 GHz. This material has very low dispersion at the wavelength of 1.5 microns, so the resonator spectrum around this wavelength is highly equidistant. Light was coupled in and out of the resonator using two optical fibers polished at the optimal coupling angle. The gap between the resonator and the fibers, affecting the light coupling and the resonator loading, was controlled by piezo positioners. The light from the input fiber that did not go into the resonator reflected off of its rim, and was collected by a photodetector. This enabled observation and measurement of the (absorption) spectrum of the resonator.

The input fiber combined light from two lasers centered at around 1,560 nanometers. Both laser frequencies were simultaneously scanned around the selected WGMs of the same family. However, they were separated by one, two, three, or ten FSRs. This was achieved by fine-tuning each laser frequency offset until the selected resonances overlap on the oscilloscope screen. The resonator quality factor $Q = 7 \times 10^7$ was relatively low to increase the linewidth and, therefore, the duty cycle of both lasers simultaneously coupled into their WGMs. The optical spectrum analyzer (OSA) connected to the output fiber was continuously acquiring data, asynchronously with the laser scan. The instrument was set to retain the peak power values; therefore, a trace recorded for a sufficiently long period of time reflected the situation with both lasers maximally coupled to the WGMs.

This work was done by Dmitry V. Strekalov and Nan Yu of Caltech and Andrey B. Matsko of OEwaves for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP *(see page 1)*. *NPO-46253*

Large-Format AlGaN PIN Photodiode Arrays for UV Images

This UV detector can be used for measuring airborne particulates and for biological agent detection.

NASA's Goddard Space Flight Center, Greenbelt, Maryland

A large-format hybridized AlGaN photodiode array with an adjustable bandwidth features stray-light control, ultralow dark-current noise to reduce cooling requirements, and much higher radiation tolerance than previous technologies. This technology reduces the size, mass, power, and cost of future ultraviolet (UV) detection instruments by using lightweight, low-voltage AlGaN detectors in a hybrid detector/multiplexer configuration. The solar-blind feature eliminates the need for additional visible light rejection and reduces the sensitivity of the system to stray light that can contaminate observations.

The AlGaN UV detector operating at 325 nm gives a 1,000× better extraterrestrial solar radiation rejection than silicon. This reduced need for blocking filters increases the quantum efficiency (QE) and simplifies the optical systems. The wide direct bandgap reduces the thermally generated dark current to levels that allow many observations at room temperature. Because of this, the AlGaN UV photodiode array doesn't require the extensive cooling (and the associated cooling cost, complexity, and weight) that silicon does, significantly reducing system cost. Wide direct bandgap materials are naturally more radiation tolerant, which is crucial for instruments located outside of Earth's atmosphere.

The device is most sensitive to UV radiation when operated in the photovoltaic mode at or near zero-reverse bias voltage. The effect of the bandgap is seen at the long wavelength cutoff of 365 nm, and shows a contrast ratio before and after the cutoff edge of better than 10^3. Between 355 and 365 nm, the QE is fairly flat, with a high of 50 percent at 360 nm at –0.5 V bias. The QE falls rapidly with decreasing wavelength reaching a minimum of 3 percent at 345 nm. The detector's current responsivity at 360 nm and 0 V bias is 0.13 A/W. The spectral detectivity is 2.6×10^{15} cm $Hz^{1/2}W^{-1}$, corresponding to a detector noise equivalent power of 4.1×10^{-18} $W/Hz^{1/2}$.

While the benefits for space-based UV detection are readily apparent, there are Earth-based applications that can benefit as well. These include plume measurements, flame sensing, UV lidar, biological agent detection, and measuring airborne particulate size and velocity.

This work was done by Shahid Aslam and David Franz of Goddard Space Flight Center. Further information is contained in a TSP *(see page 1)*. *GSC-15673-1*

Fiber-Coupled Planar Light-Wave Circuit for Seed Laser Control in High Spectral Resolution Lidar Systems

The compact, efficient, and reliable design enables use on small aircraft and satellites.

Langley Research Center, Hampton, Virginia

Precise laser remote sensing of aerosol extinction and backscatter in the atmosphere requires a high-power, pulsed, frequency doubled Nd:YAG laser that is wavelength-stabilized to a narrow absorption line such as found in iodine vapor. One method for precise wavelength control is to injection seed the Nd:YAG laser with a low-power CW laser that is stabilized by frequency converting a fraction of the beam to 532 nm, and to actively frequency-lock it to an iodine vapor absorption line. While the feasibility of this approach has been demonstrated using bulk optics in NASA Langley's Airborne High Spectral Resolution Lidar (HSRL) program, an ideal, lower cost solution is to develop an all-waveguide, frequency-locked seed laser in a compact, robust package that will withstand the temperature, shock, and vibration levels associated with airborne and space-based remote sensing platforms.

A key technology leading to this miniaturization is the integration of an efficient